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and lava splashes, showing conditions of fusion, manner, or extent of aerial transit, etc. All these features are well illustrated with photographs, and the bulletins could be read with great profit by students and teachers of geology and geography.

A. P. B.

THE NEW SEAPORT OF ZEEBRUGGE, BELGIUM.

In mediæval times the City of Bruges ranked among the most flourishing of European ports. At that period Bruges held direct communication with the North Sea by means of an estuary; but gradually this was filled up with sand, and the old Hanseatic town fell from its high estate.

At the present day vast maritime undertakings are being developed, with the two-fold object of reviving the commercial prosperity of Bruges and of founding a port of call for the whole country. The new town has been christened Zee Brugge (Bruges-on-Sea).

For a port of call the Belgian coast is advantageously placed, as its situation is such that it can admirably knit together both land and sea going traffic without loss of time, uniting security with rapidity to such a degree that the mechanism of transit is perfected. On the one side a continuous current of merchandise passes within sight of the Belgian coast, conveyed by the great German shipping lines from Hamburg and Bremen, and on the other a radiation of railways stretches towards Paris, Berlin, St. Petersburg, Vienna, Constantinople, and Italy. These two great trade lines, converging on Zeebrugge, will be of mutual assistance, and will enormously facilitate the inflow of produce all over Europe.

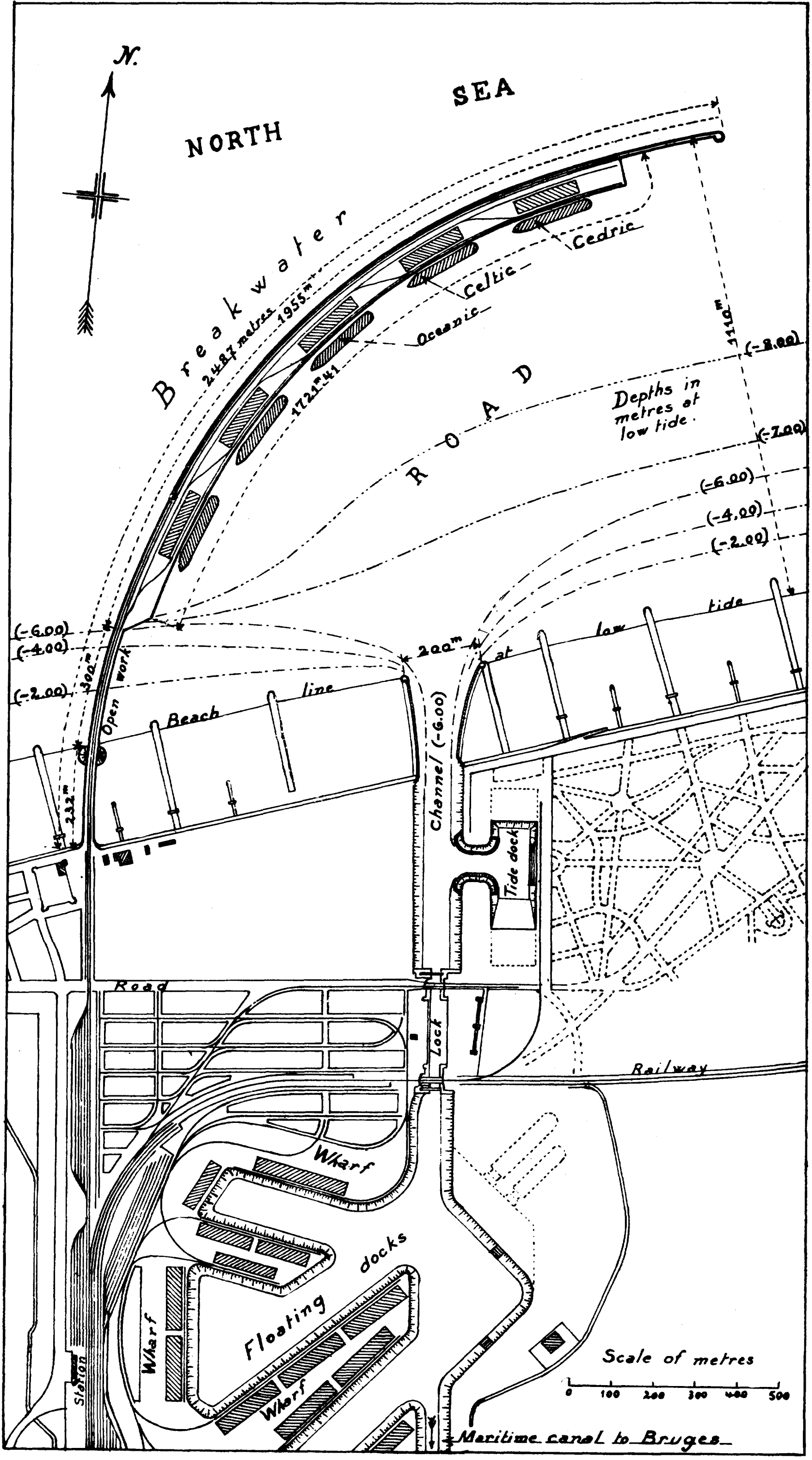
The works in progress consist of three parts: the actual port of call at Zeebrugge, the canal uniting Bruges and the sea, and, lastly, the local installations at Bruges.

As the plan shows, the chief feature of the port of call is an immense breakwater or pier which runs out from the land, curves to the east, and finally stretches parallel to the coast 1,200 yards from low-water mark.

This breakwater encloses and protects against the prevailing south and northwest winds a harbour 420 acres in extent.

The breakwater consists of three parts. From the shore runs

PLAN OF THE NEW HARBOUR OF ZEEBRUGGE (BELGIUM).



a solid pier to the distance of 253 yards; then come 328 yards of open work, and this is followed by another length of solid masonry measuring 2,138 yards—in all, more than 2,700 yards.

The object of the open-work portion is to maintain as far as possible the circulation of the tidal currents in the harbour, in order that the mud may not settle. Here it may be remarked that the actual landing-stage is situated outside the zone of water subject to the influence either of tidal movements or of the Scheldt.

There is very little sand, and silting is not a menace as at other points of the coast. However, considerable quantities of mud are held in suspension in the sea, and it is to prevent the gradual sinking of this mud in the harbour that the open work has been built. This arrangement is quite an innovation, and minimises the difficulties experienced in constructing an artificial port on a muddy shore.

The open work part is of steel. It is 13 yards wide, has two lines of rail (each 1.64 yard in width with a 9-foot way between) and two side passages of about 3 yards each. The superstructure rests on iron pillars driven into the ground.

The third part of the breakwater, a continuation of the open work, is also an innovation. It consists of two parallel walls enclosing a space 81 yards in width and forming a vast platform. The outer wall protects the platform against the violence of the sea; while the inner or harbour wall forms a quay alongside which ships can be berthed and unloaded.

The outer wall is built on a foundation of concrete blocks each 3,000 tons in weight, 27 yards long and 8 yards wide. The height of these blocks varies according to the depth of the sea, in order that the top may always be just a yard above low-water mark. On these blocks three other layers of concrete are placed in masses of 55 tons till a height of seven yards and a thickness of ten yards are reached. Crowning all this is a slighter sheltering wall some five yards high. At the extremity of the breakwater a lighthouse will be built. The length of the inner wall of the platform on the harbour side is 1,882 yards.

The depth alongside the quay is:

(*a*) For 800 yards, low water 26 feet 3 inches, high water 41 feet 4 inches.

(*b*) For 390 yards, low water 31 feet 2 inches, high water 46 feet 3 inches.

(*c*) For the remaining part (492 yards), low water 37 feet 9 inches, high water 52 feet 10 inches.

No continental port can show such anchorage, and it is clear that Zeebrugge is capable of meeting the most exacting demands made by the unceasing growth of modern commerce.

The quay, like the breakwater, is built up of concrete, and, where the anchorage is deepest, the foundation consists of huge blocks varying in length from 26 to 33 yards and weighing as much as 9,000 tons. The superstructure is formed of the smaller 55-ton blocks. On this will be laid out railways, a station for passengers, sheds for goods, electric cranes, etc., all with the latest improvements. It will be possible to load and unload directly from the railway, so that not a moment will be lost, and, as this railway will be the starting-point for all parts of Europe, trade will more and more tend to converge towards Zeebrugge.

At a distance of 900 yards from the shore end of the breakwater is the channel, giving access to the lock which affords entrance to the interior docks of Zeebrugge and the Bruges Canal. The opening and shutting of the lock are effected by electric power. This lock is 66 feet wide; the depth of the water varies from 18 feet to 30, according to the tide. The interior docks of Zeebrugge consist of a central dock, 720 yards long, a wet dock that will allow a ship 720 feet long to turn, and a series of small docks to the west.

The new canal runs in a straight line to Bruges. It is 6⅕ miles long, 25 feet deep, and 72 feet wide at the bottom. It reaches to the new docks at Bruges; two large wet docks, and a third with turning room for a 520-foot vessel.

The quays have railways, sheds, and steam cranes.

The work was begun in March, 1896, and will probably be finished in 1905, at a total cost of 2,400,000 pounds sterling.

C. Piens,
Ingénieur principal des Ponts et Chaussées.

Bruges, 10th February, 1904.